

# Rare earth element partitioning between plagioclase and granitic melt

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Petrogenesis of Archean granitoids is of significance for understanding the crustal evolution in the early Earth. One of the most serious problems in this issue is that the whole rock chemistry of such a coarse-grained rock is most unlikely to represent the nature of primary magma because they would have suffered from highly fractionation during crystallization.

Here we propose a new method to estimate the chemical nature of primitive magmas of Archean granitoids by using rare earth element (REE) concentration in plagioclase. The distribution of REE is sensitive to fractionation of minerals during crystallization. Plagioclase crystallizes earlier in the granitic system and has a slow diffusion rate so that it preserves most reliable records of early stage of crystallization. The REE composition of primitive melt can be estimated by a combination of REE concentration in highest XAn core of plagioclase in the rock with experimentally-determined partition coefficient for REE between plagioclase and coexisting melt.

However, previously reported partition coefficient for REE between plagioclase and melt were determined in implausible conditions for the petrogenesis of granite (e.g., basaltic system, dry condition, or 1 atm condition).

We conducted experiments to synthesize plagioclase coexisting melt in a hydrous granitic system at 1.2 GPa and 900C in a piston-cylinder apparatus. The starting material was Ho, Tm, and Yb-doped (100ppm for each) Archean granite from Mt. Edgar batholith in Pilbara craton, western Australia. The granite powder was loaded into Au-Pd capsule with 4.5 wt.% free water. The REE concentrations in synthesized plagioclase and coexisting glass (melt at high-T) were obtained by a secondary ion mass spectrometry (SIMS).

We will compare the partition coefficients determined in this study with those of previous works. Then, we apply our partition coefficients for plagioclase of Archean granite in the Mt. Edgar Batholith in order to obtain the REE compositions of its primitive magma. We further discuss the tectonic setting to form the primitive granitic melt in Archean.